



Measuring perceptions on risk management: example with an ongoing work applied to landslide hazards.

WP3

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Content



- Part I: Background
 - WP 3
 - Risk management
 - Scope of work
- Part II: The survey
 - The Risk Management Index
 - The survey - content
 - The survey – preliminary results




WP 3 Landslides triggered by hydro-meteorological processes

Goal:

- Innovative measures for risk reduction
 - Innovative: improved existing, or new.
 - Cost-effective risk reduction measures

Tasks within WP 3

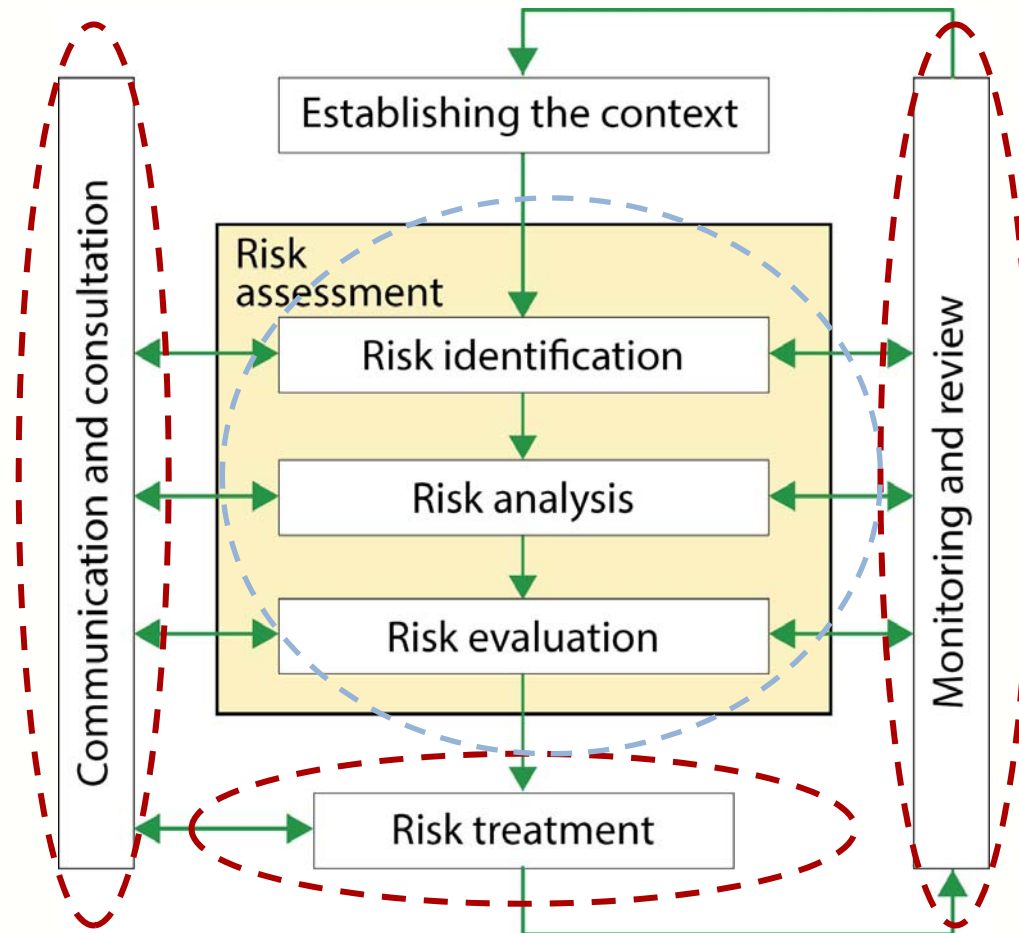
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- WP3.1. Development of analytical and numerical codes.
 - WP3.2. Environmentally sustainable methods for improving drainage and stabilizing soil and rock slopes
 - WP3.3. Protection of critical infrastructure (CI) from landslides.
 - WP3.4. Early-warning systems (EWS).
 - WP3.5. Management of landslide risk**

Risk Management



- (1) What can cause harm?** → danger identification
- (2) How often?** → frequency of occurrence (hazard)
- (3) What can go wrong?** → consequence
- (4) How bad?** → severity of consequence
- (5) What should be done?** → acceptability/tolerability of risk, decision-making and mitigation

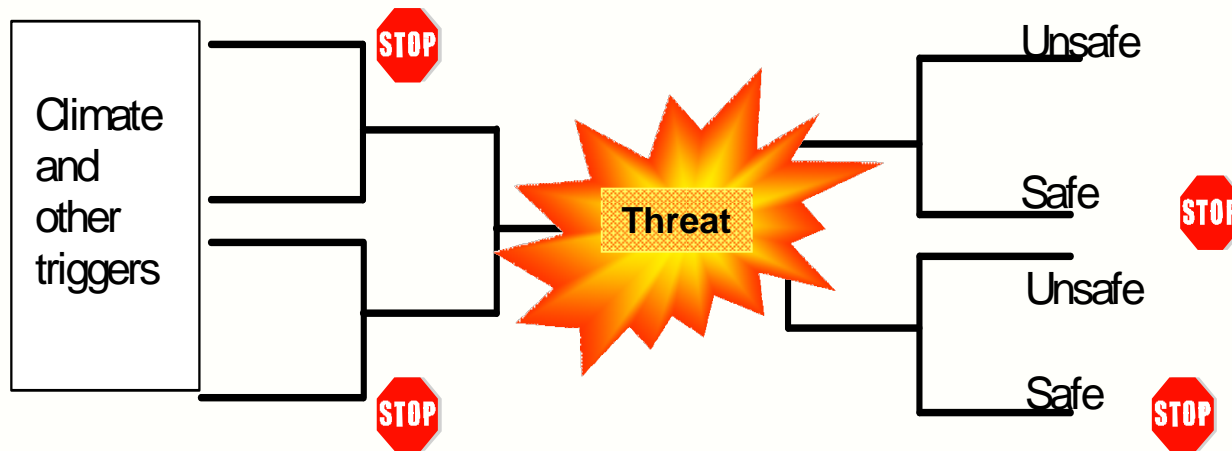
Risk management process [after ISO-31000:2009]





Causes/triggers

*Consequences
(Elements at risk and vulnerability)*



Hazard-reducing measures

Consequence-reducing measures

RISK MITIGATION

Mitigation strategies for landslides

(Dai et al. (2002))


Structural mitigation measures:

- Engineering solution strategy: reducing either the probability of landsliding or the probability of spatial impact of a landslide;

Non-structural mitigation measures:

- Planning control: reducing expected elements at risk;
- Monitoring and warning system: reducing expected elements at risk by evacuation in advance of failure.
- Acceptance strategy: Risk considered as acceptable or unavoidable;

Structural mitigation measures for landslides

- 
- Slope stabilisation, drainage, erosion protection, channelling, vegetation, ground improvement, dams, barriers, catching nets, terrain modifications, anchoring and retaining structures etc.
 - Purpose:
 - To prevent slide release
 - Stop landslides or lead them into areas where they do less or no damage
 - Design and construct buildings to withstand slide forces.







Mitigation strategies for landslides; Non-structural mitigation measures.

1. Good land use planning.
2. Proper and enforced building codes and good construction practice.
3. Establishment of early warning systems
4. Emergency preparedness: Establishment and maintenance of network of escape routes, safe places, etc.
5. Ensure public awareness and a community preparedness; build up competence regionally and locally.
6. Build up and maintain a functioning society; health, education, communication, transport, rescue and relief, etc., etc.
7. Risk transfer by implementing measures to pool and transfer the financial consequences of particular risks.

Scope of the survey

- 
- Risk Identification (RI) - Individual and social risk awareness of landslide hazards, methodological approaches in landslide hazard assessment.
 - Risk Reduction (RR) - Prevention and mitigation measures against landslides
 - Disaster Management (DM) - Response and recovery following a disaster
 - Governance and Financial Protection (Loss Transfer) (FP) - Allocation and use of financial resources for dealing with disaster

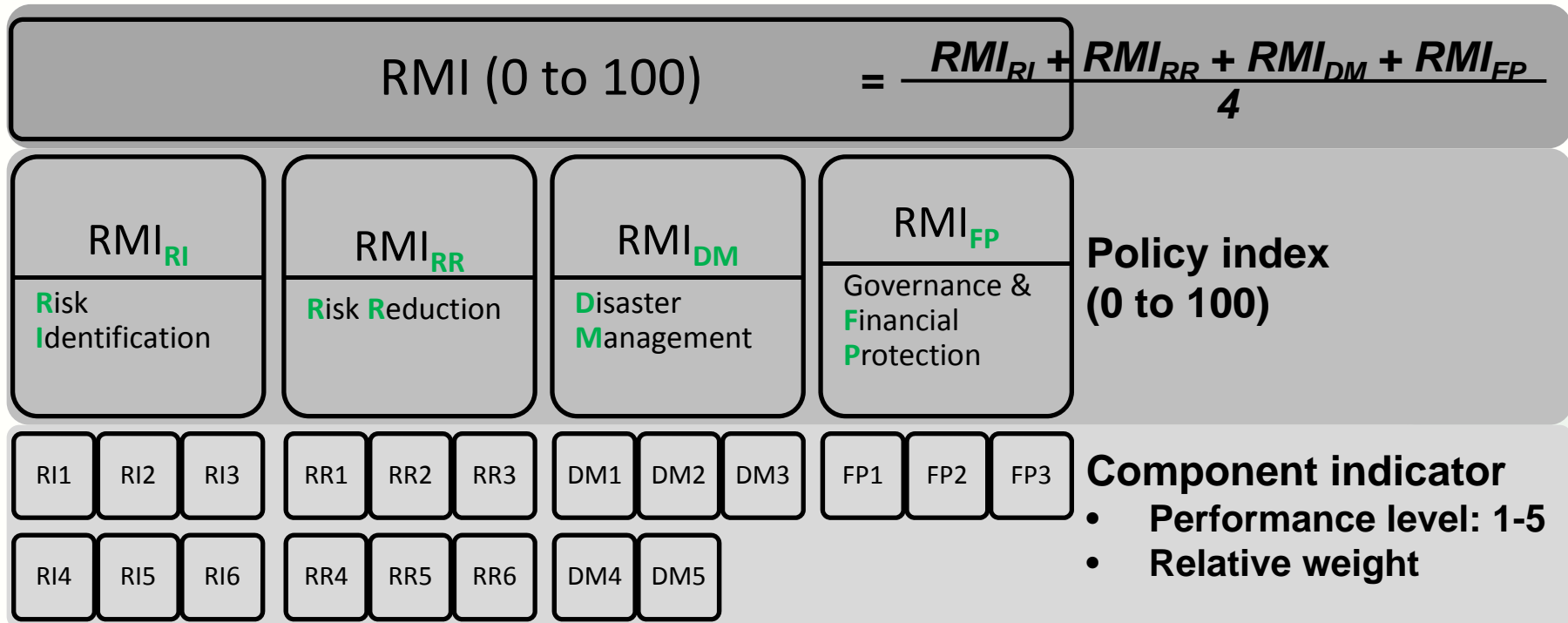
Aim of the work

- 
- Adequate procedures for management of landslide risk provide the framework to ensure that risk mitigation measures are adequately integrated in the practice in the building/construction/transportation sectors.
 - This opinion survey is expected to provide insights on areas for improvement which will aid in prioritizing future work plans in Klima 2050, i.e. identification of prioritization areas (WP3 and WP4).



The survey

Cardona's Risk Management Index (RMI)



*handout

Performance levels:

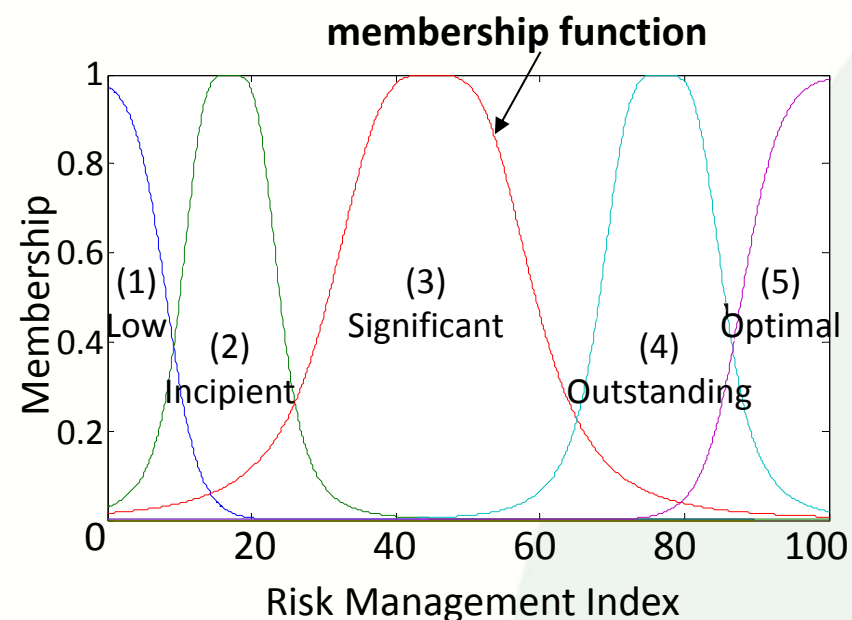
1. Low 2. Incipient 3. Significant 4. Outstanding 5. Optimal

RI1. Systematic disaster and loss inventory

Mapping of loss caused by landslides in previous events; coverage and quality (incl. degree of details and systematicity)

1. **Some basic** and **superficial** data on the previous landslide events
2. Continual registering of current landslide events, **incomplete** catalogues of the occurrence of some events and limited information on losses and effects.
3. **Some complete** catalogues of landslide events, systematisation of actual events and their economic, social, and environmental effects.
4. **Complete** inventory and multiple catalogues of landslide events; registry and detailed systematization of effects and losses.
5. **Detailed** inventory of events and effects for **all** landslides events as well as corresponding consequences.

A fuzzy set:



The survey, e.g. RI1

M = Municipality; C = County; N = National

RI1. Systematic disaster and loss inventory		2015			2050		
		M	C	N	M	C	N
Mapping of loss caused by landslides in previous events; coverage and quality (incl. degree of details and systematicity)	Low						
	Incipient						
	Significant						
	Outstanding						
	Optimal						
	Not relevant Not able to answer						

Low: Some basic or superficial data on previous landslide events.

Incipient: Continual registering of current landslide events, incomplete catalogues of the occurrence of some events and limited information on losses and effects.

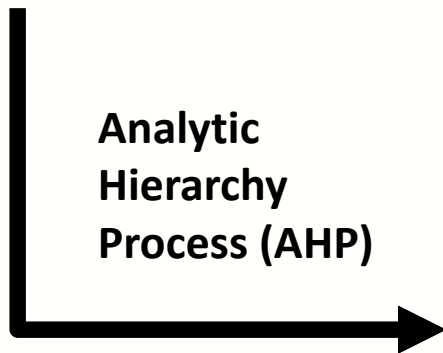
Significant: Some complete catalogues of landslide events, systematisation of actual events and their economic, social, and environmental effects.

Outstanding: Complete inventory and multiple catalogues of landslide events; registry and detailed systematisation of effects and losses.

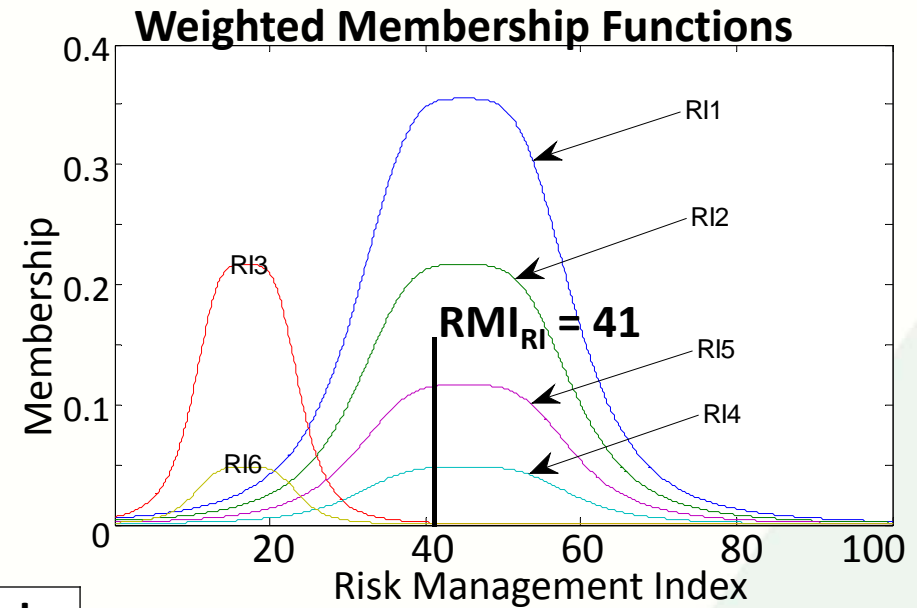
Optimal: Detailed inventory and complete mapping of all landslide events as well as corresponding consequences.

Relative weights:

E.g. Risk Identification (RI)			
Which one is more important?		In which degree? (1 to 9) 1 = equally important 9 = 9 times more important	
RI1	vs		RI2
RI1			RI3
⋮			⋮
RI5			RI6



Standardised relative weights
$w_{RI1} = 0.35$
$w_{RI2} = 0.22$
$w_{RI3} = 0.22$
$w_{RI4} = 0.05$
$w_{RI5} = 0.12$
$w_{RI6} = 0.05$



$$RMI_{RI}$$

= Centroid of fuzzy set

$$= \frac{\text{sum of moments}}{\text{sum of areas}}$$

In addition...



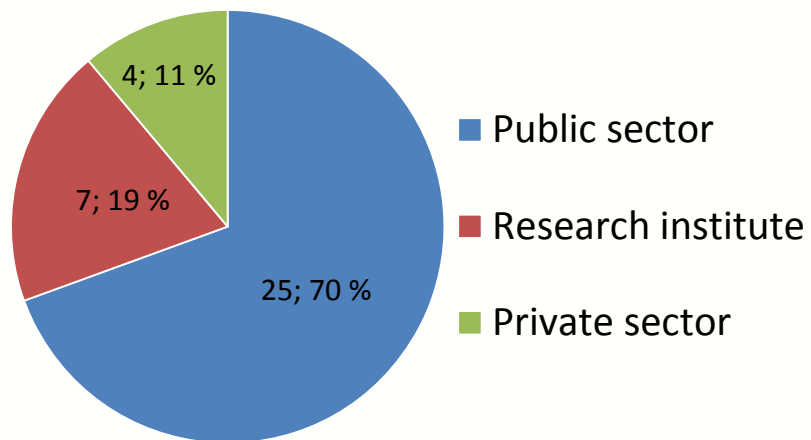
- Which factors considered for 2050?
- Comments on:
 - landslide risk management in Norway
 - the survey

Survey response

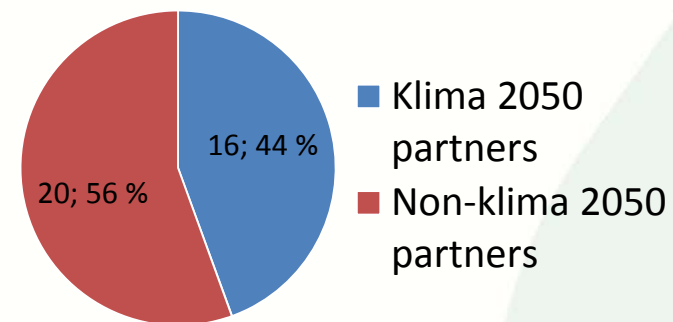


- Questionnaires sent by email
- Sept-Oct 2015
- No. of response: 28 + 8 (MSc work in early 2015) = 36

Type of organisation



Klima 2050 partners

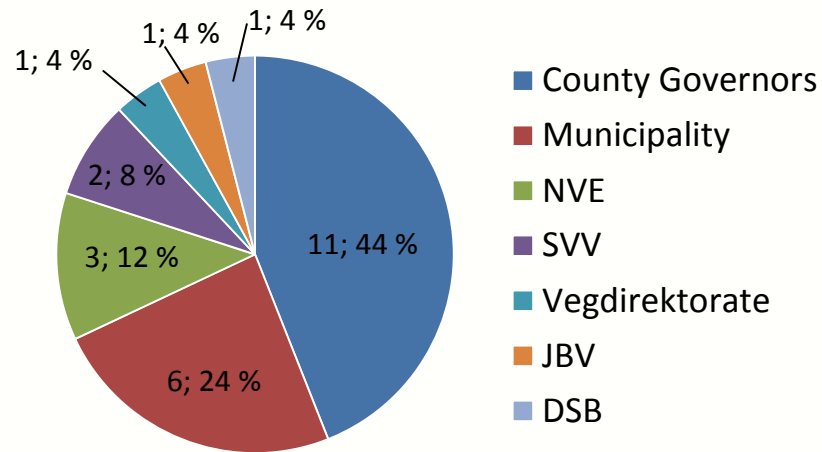


Background of respondents



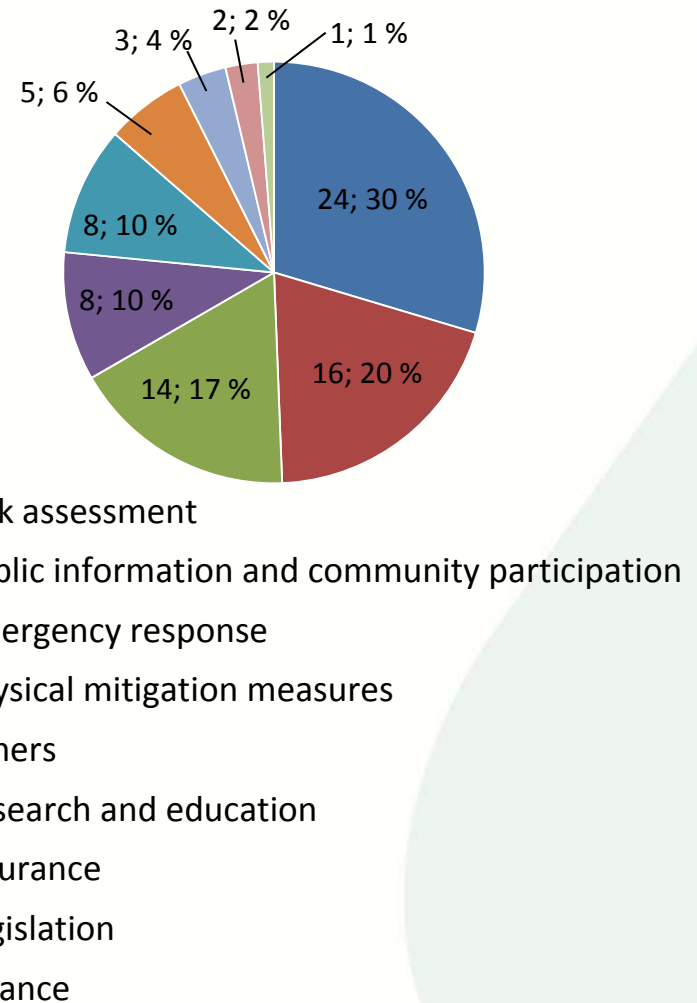
86% seniors/experts

Organisation in public sector



- Private: Saint-Gobain Weber, Multiconsult, Norwegian Natural Perils Pool, If P&C Insurance
- Research institutes: NGI, SINTEF, NTNU

Discipline in landslide risk management



↗ 3 counties/municipalities most familiar with

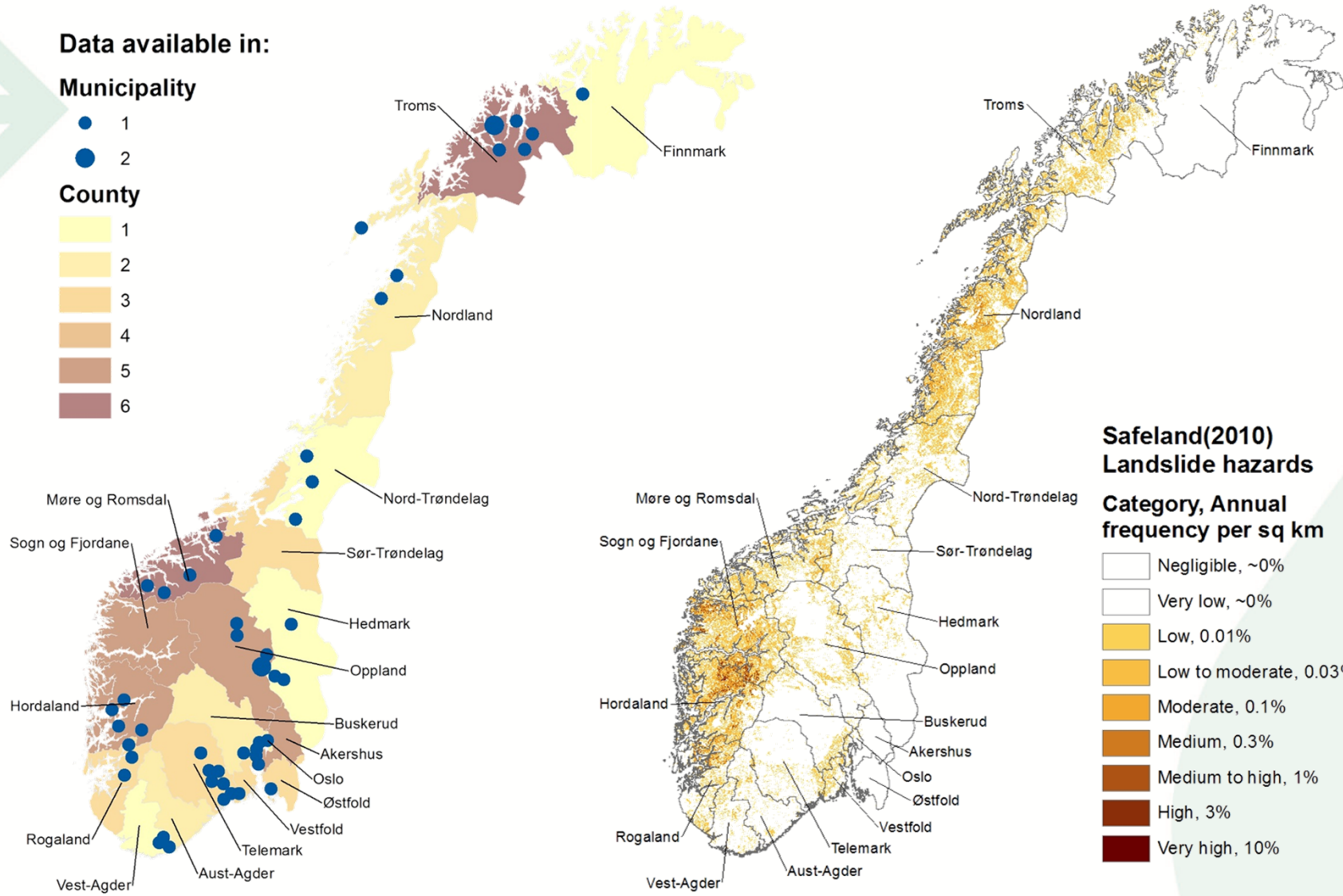
Data available in:

Municipality

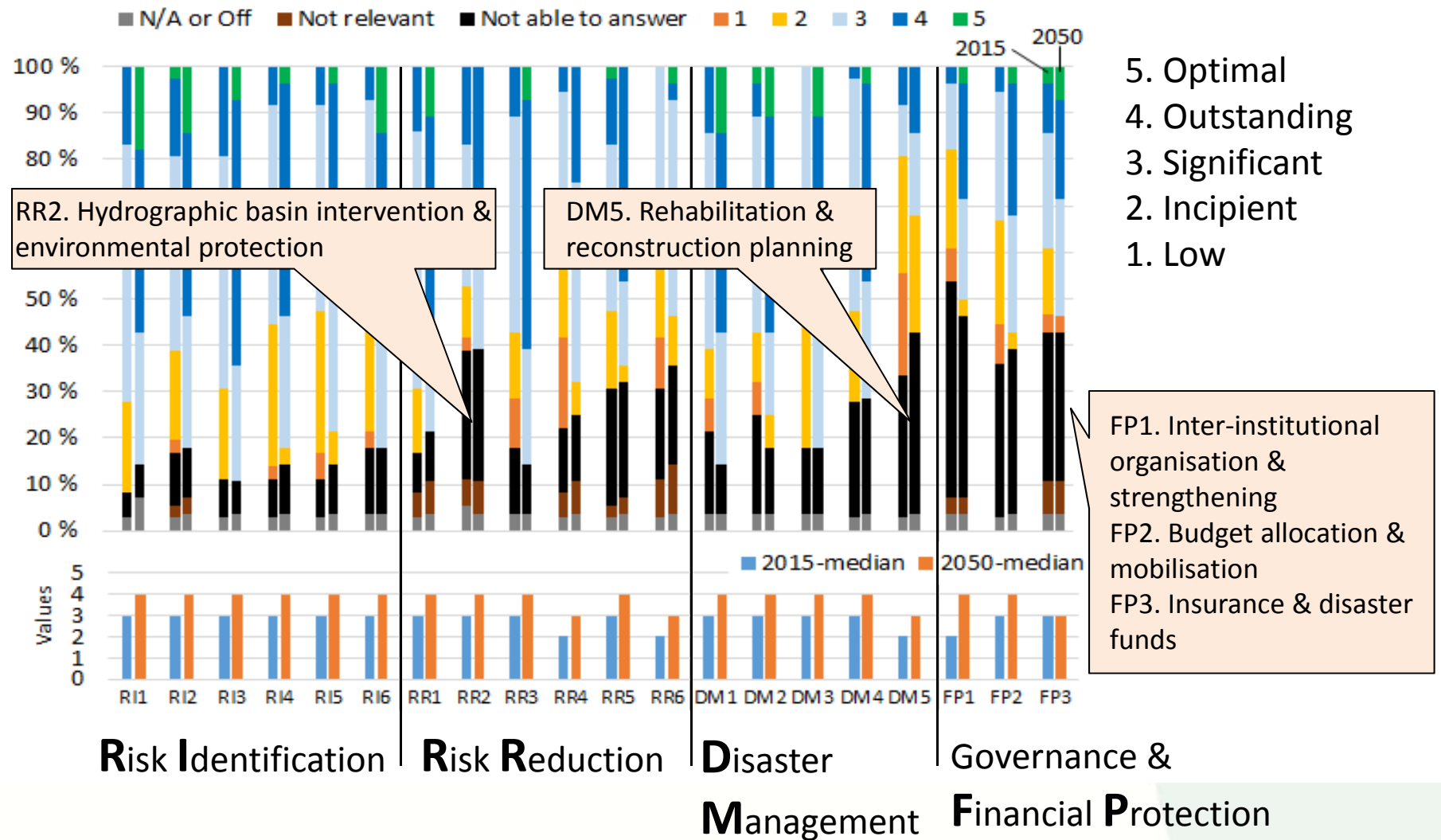
- 1
- 2

County

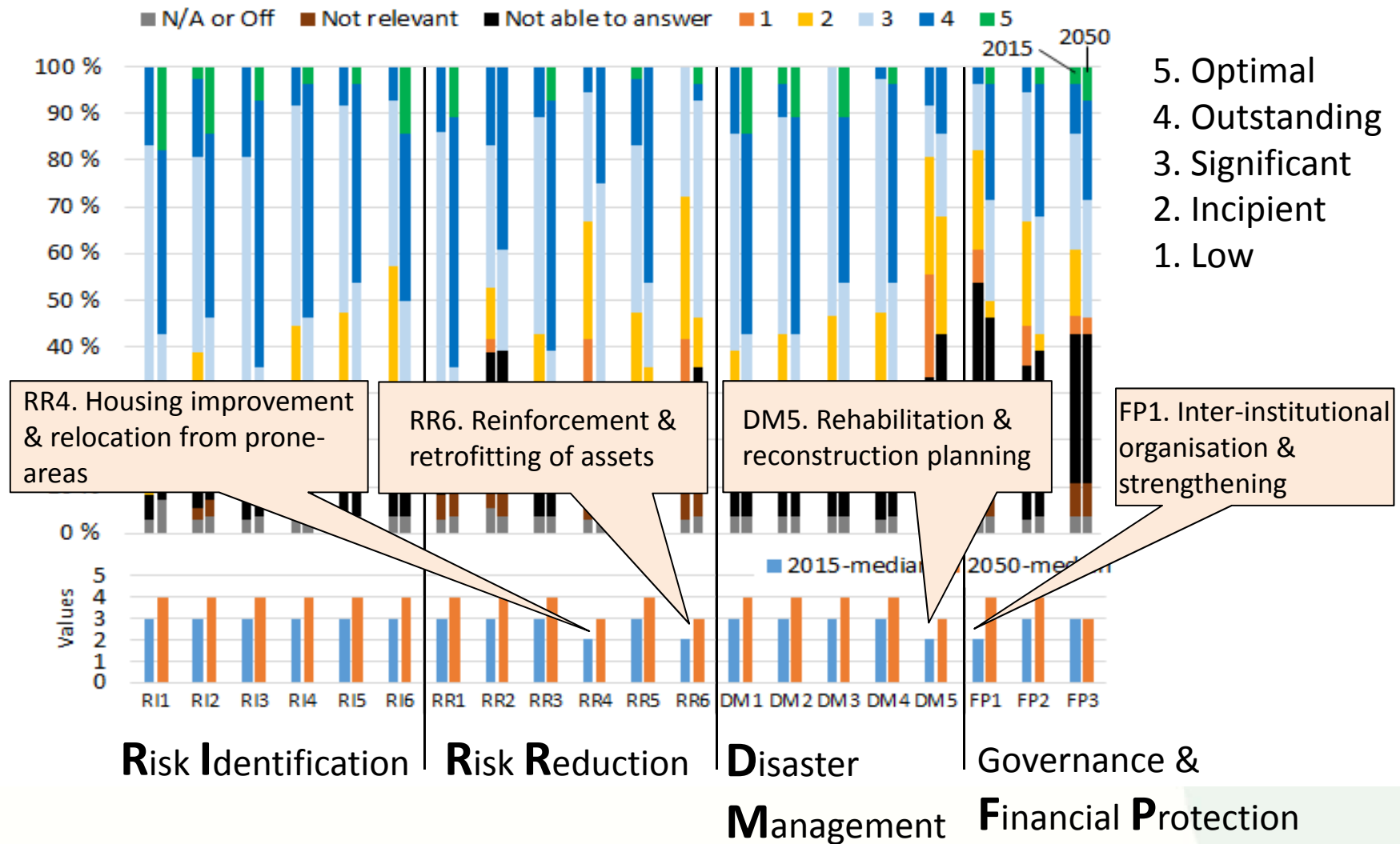
- 1
- 2
- 3
- 4
- 5
- 6



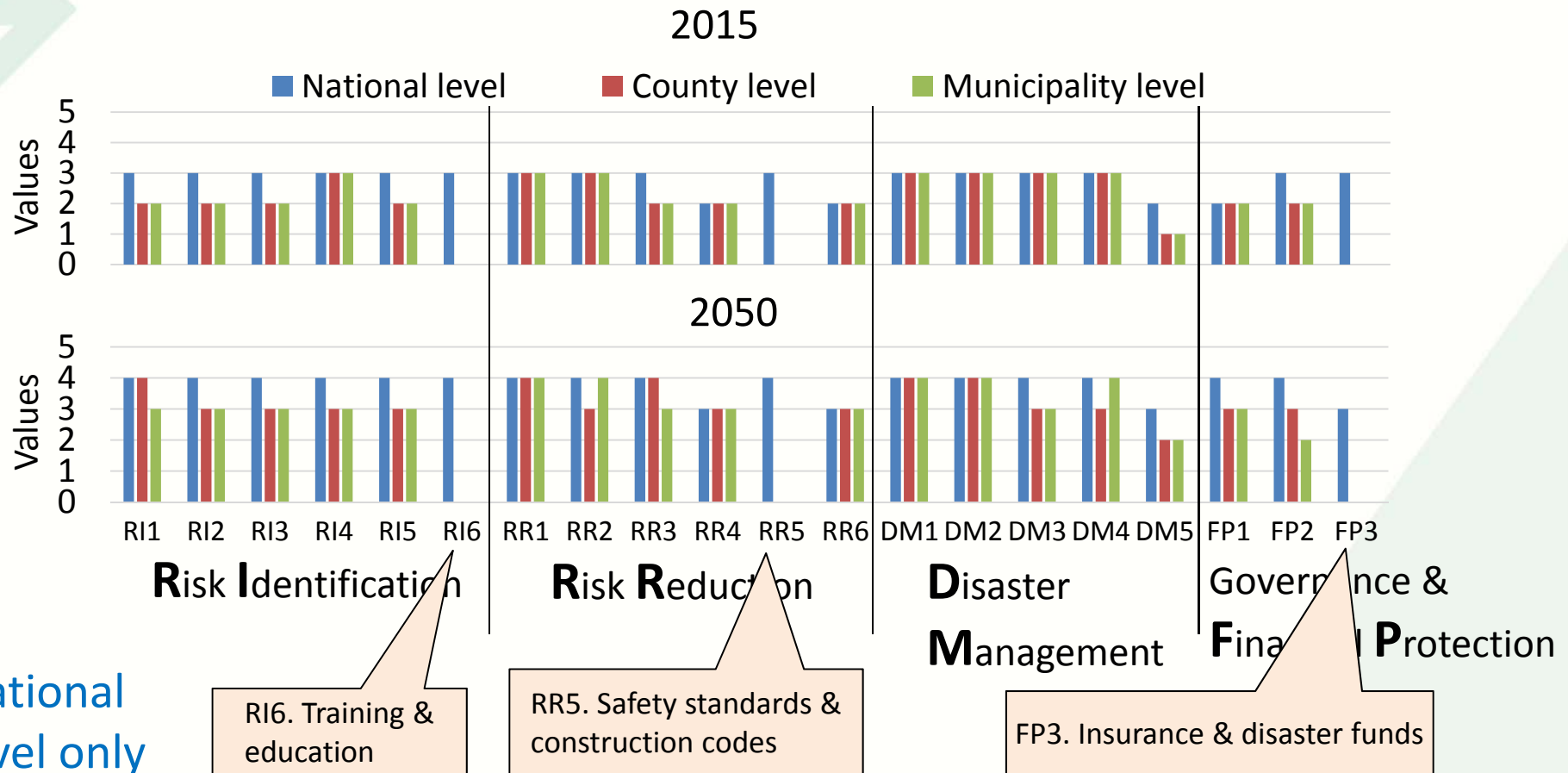
National level performance – 2015 & 2050



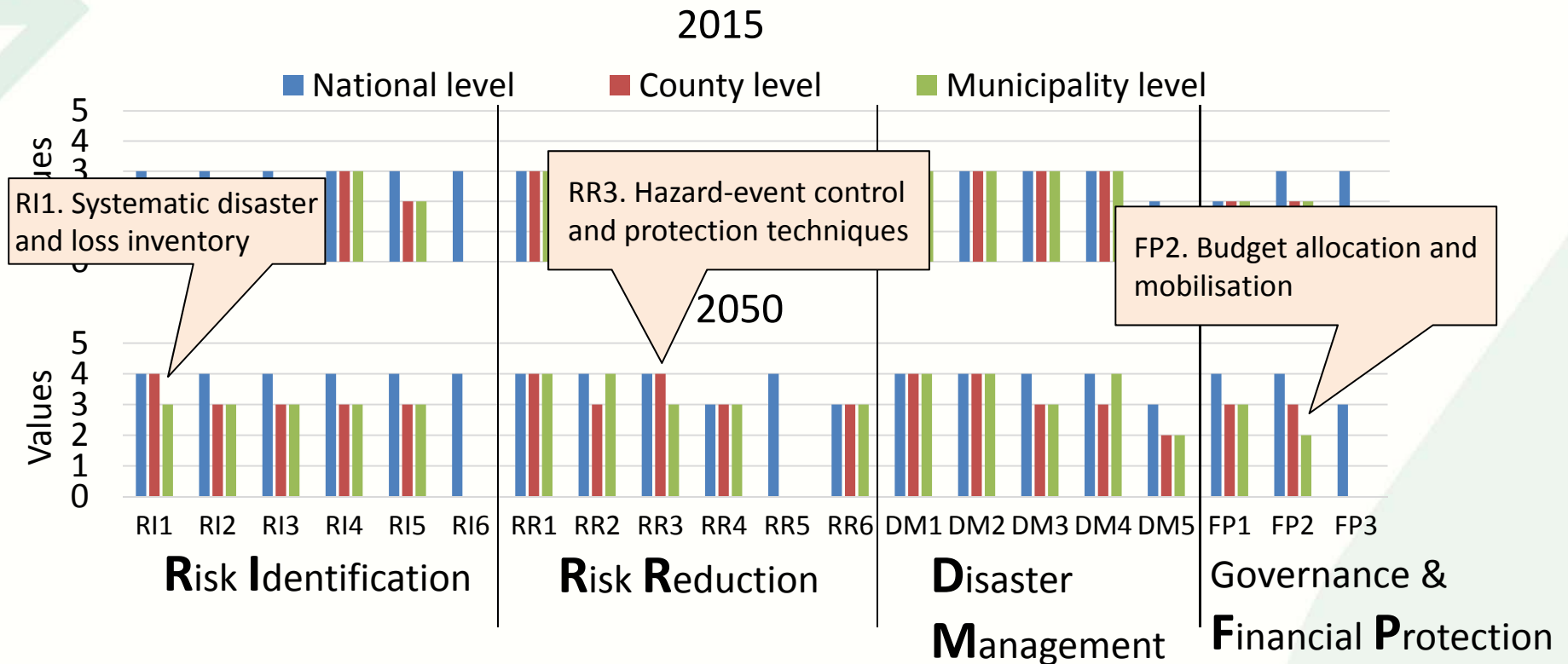
National level performance – 2015 & 2050



Performance (medians) for different administrative divisions

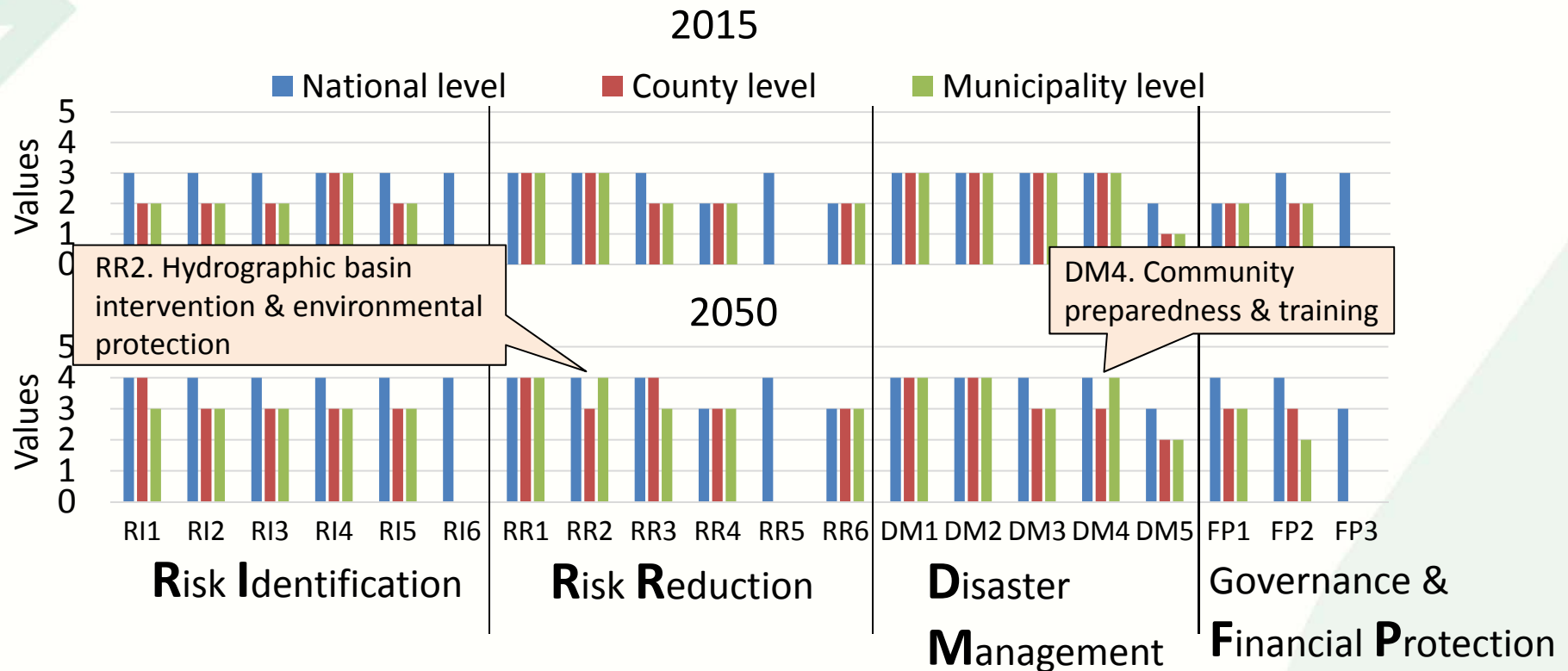


Performance (medians) for different administrative divisions



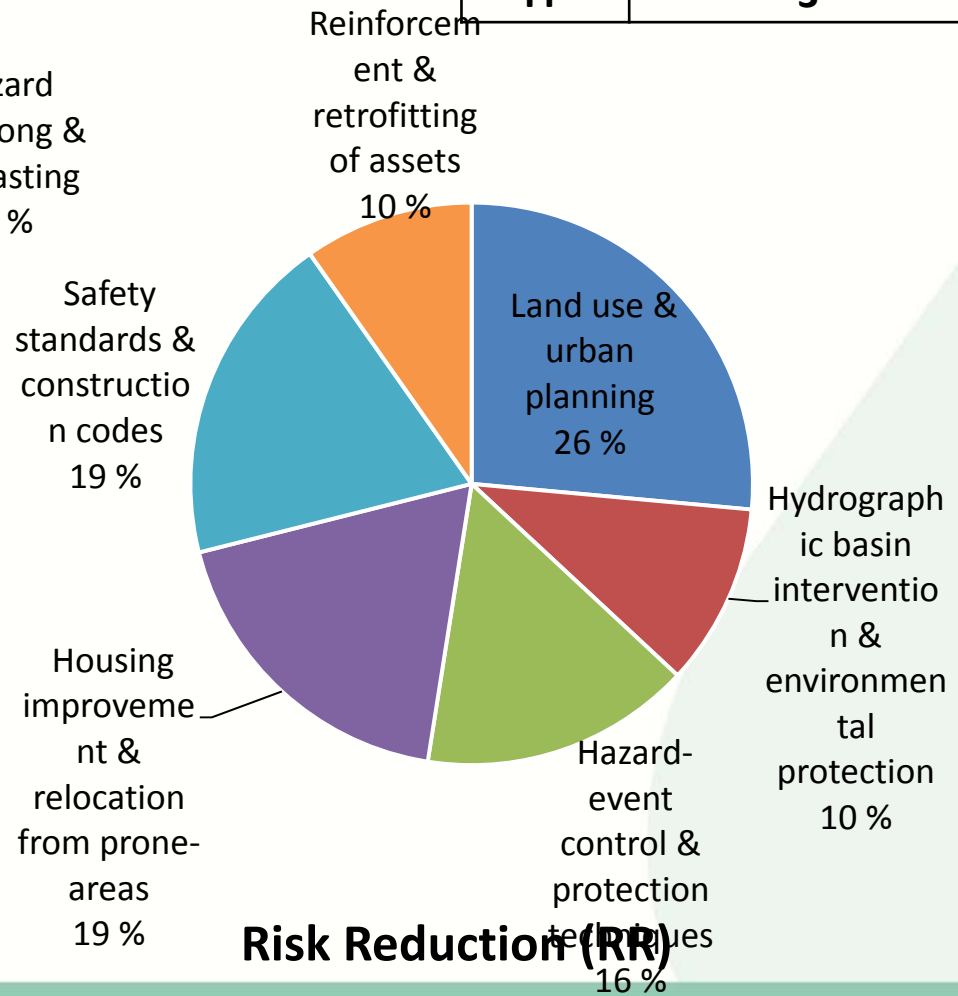
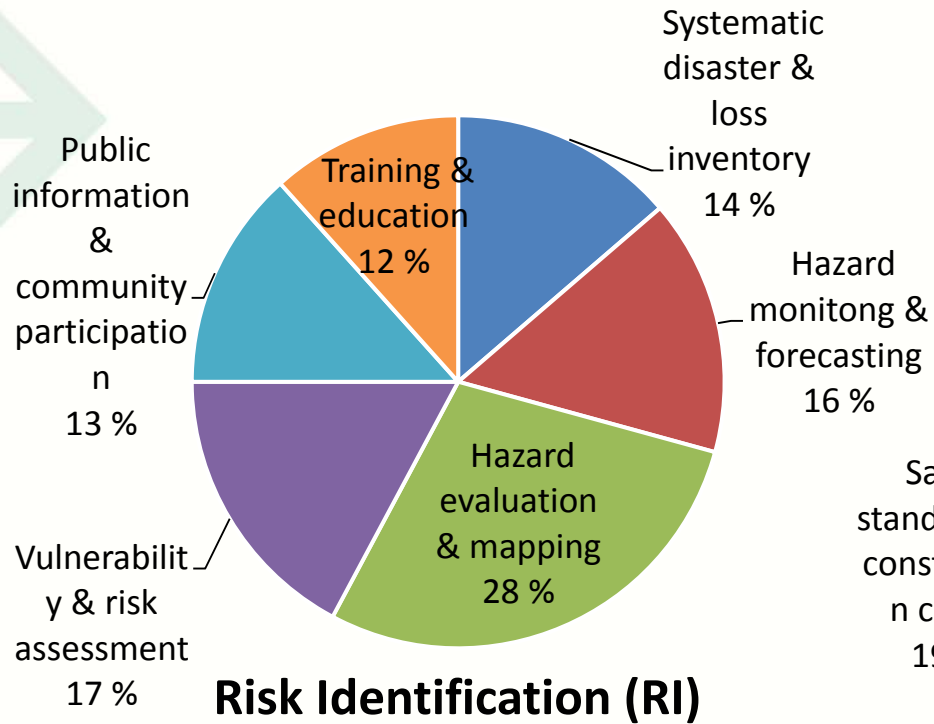
2050 Perceptions: County better than municipality

Performance (medians) for different administrative divisions



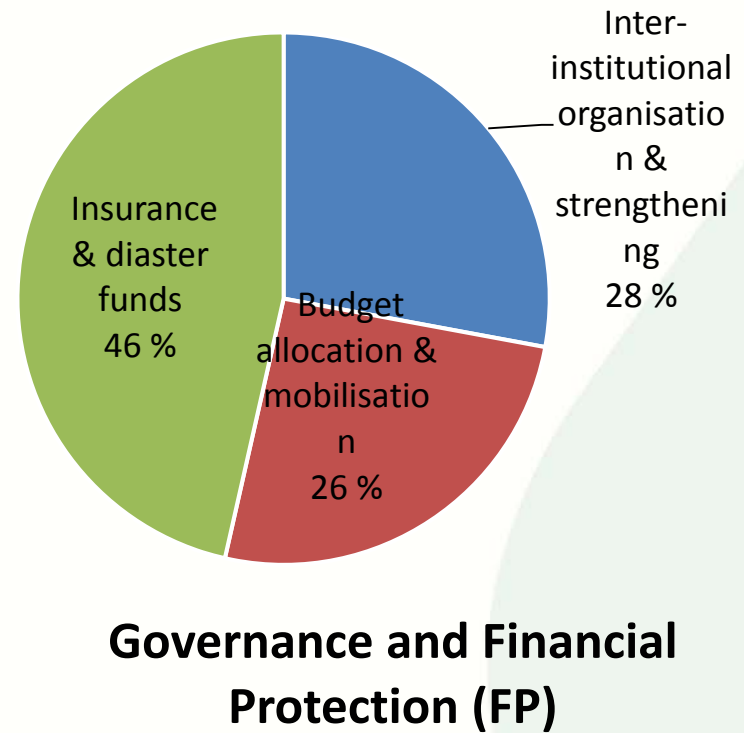
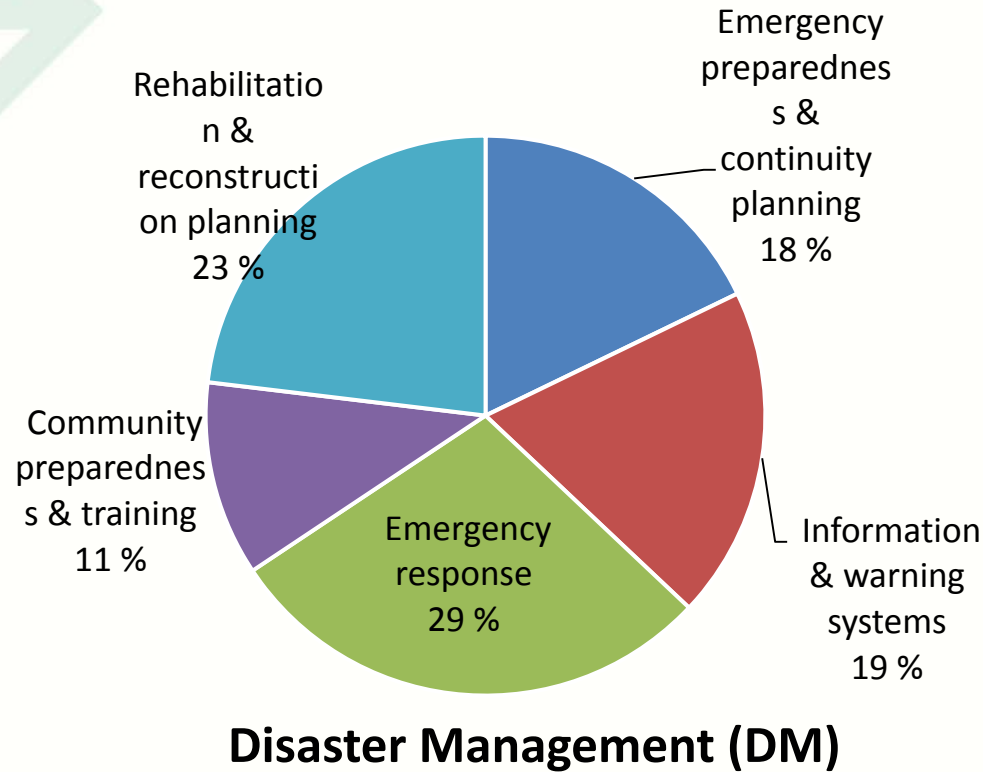
AHP weighting – RI, RR

Policy	No. of data
RI	7
RR	5
DM	5
FP	3

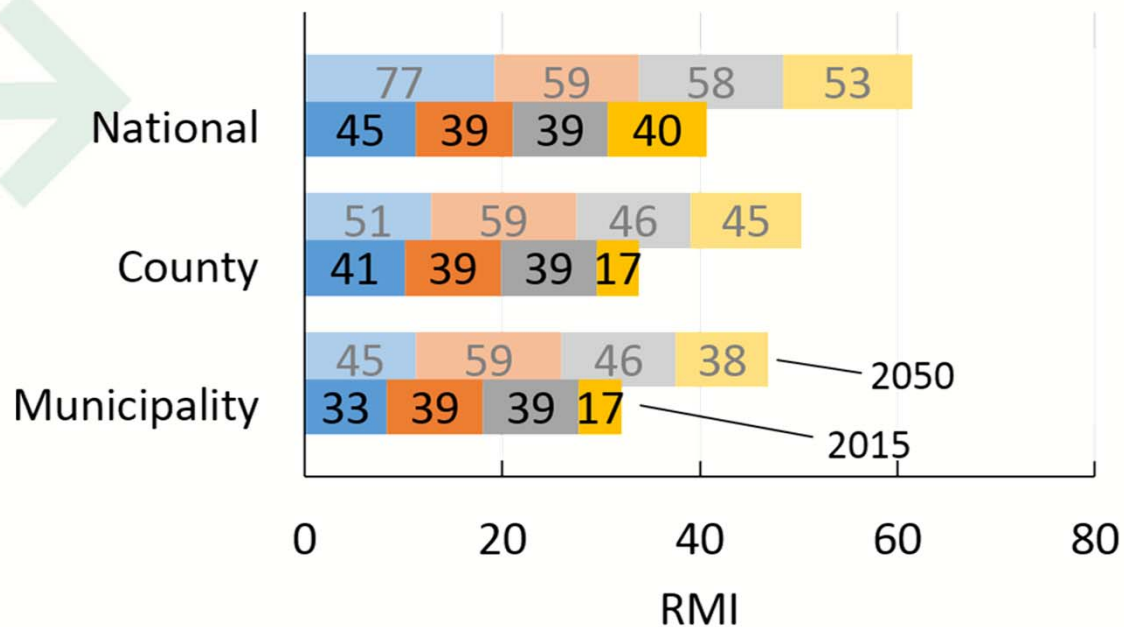


AHP weighting – DM, FP

Policy	No. of data
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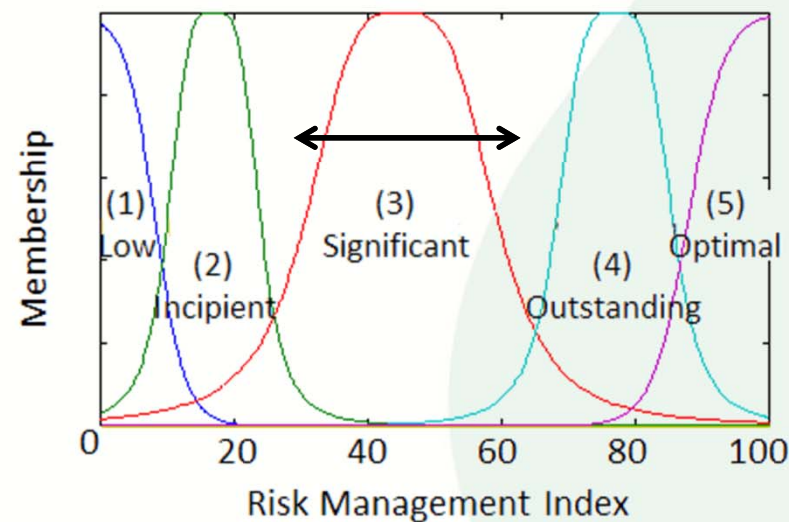
RMI



■ RMI_{RI}
 ■ RMI_{RR}
 ■ RMI_{DM}
 ■ RMI_{FP}

	National		County		Municipality	
Year	2015	2050	2015	2050	2015	2050
RMI	41	62	34	50	32	47

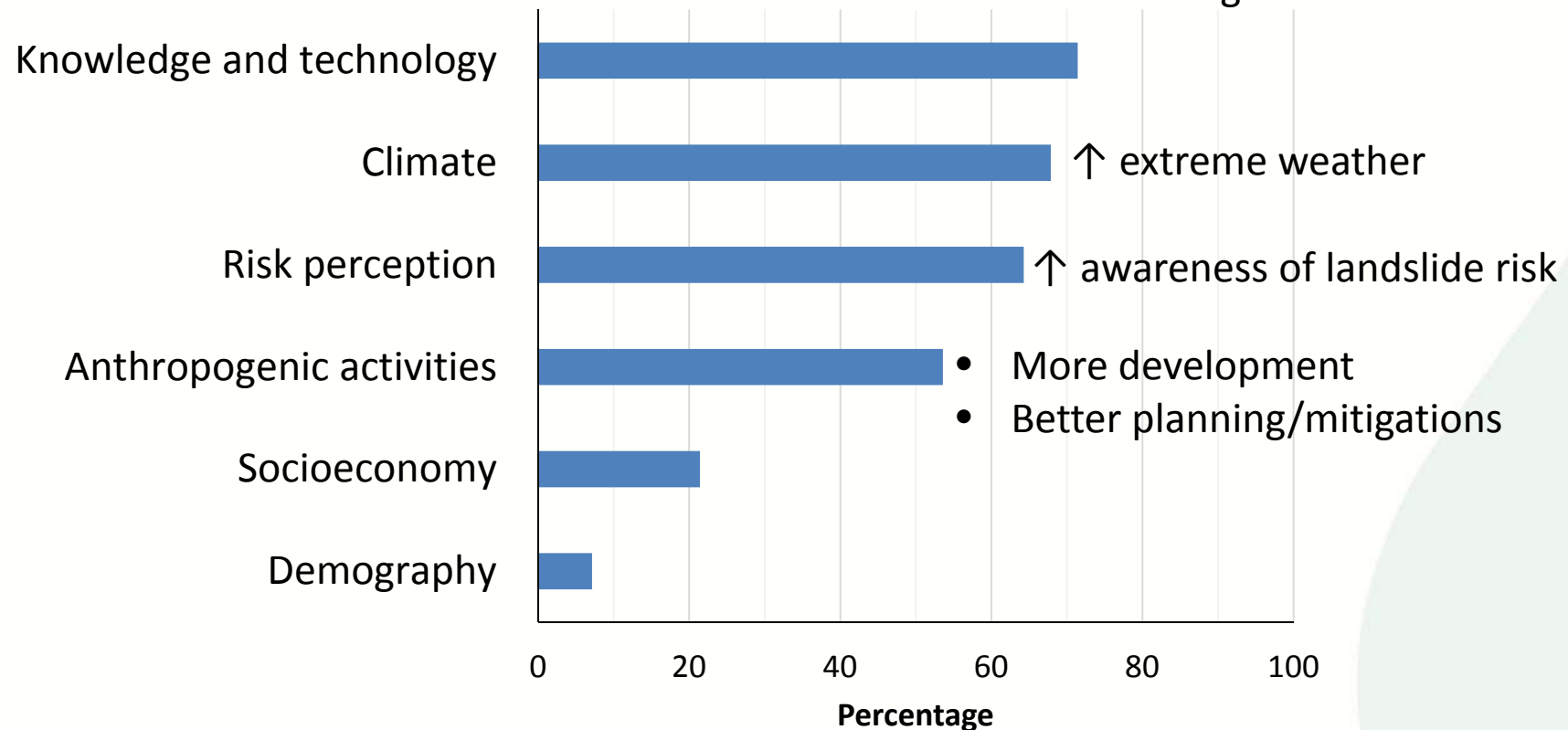
- Risk Identification
- Risk Reduction
- Disaster Management
- Governance & Financial Protection



Factors considered for 2050



- Longer tradition, more experiences
- More advanced monitoring & warning system, modelling
- Better knowledge in hazardous areas





General comments about landslide risk management in Norway

➤ Positive

- Been improving in general
- More focus on media, which arouses awareness
- Improvement in organisation and mapping work

➤ Negative

- National responsibility is fragmented and not coordinated, and lags behind other administrative levels
- Most municipalities: too little knowledge in risk identification and reduction
- Mapping work inadequate
- Too little focus on existing developed areas and infrastructure (and between).

➤ Recommendations

- More resources for mapping and mitigation measures
- Overview and sharing of data

General comments about the survey



➤ Positive

- Good and relevant questions
- Systematic
- Good with explanations of criteria

➤ Negative

- Too difficult
- Too comprehensive
- Some criteria are unclear
- Too many technical terms

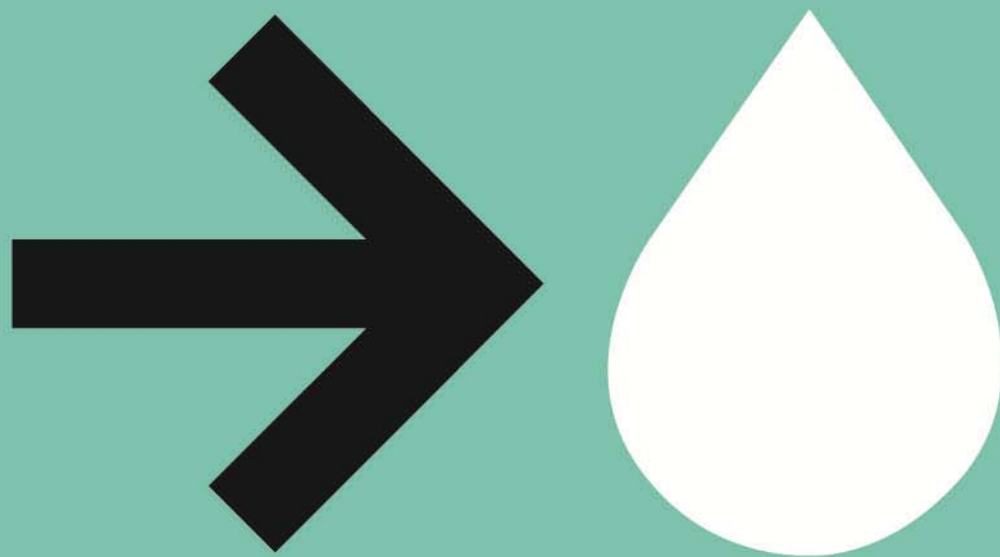
➤ Recommendations

- Simpler wordings
- Interview

Observations from survey results

Summary

- Perceptions: not optimal
- More positive perception for national level
- More positive perception on landslide risk management for future
- Focus in each public policy:
 - Hazard evaluation and mapping
 - Land use and urban planning
 - Emergency response
 - Insurance and disaster funds
- Major factors that can influence performance of landslide risk management in Norway in 2050:
 - Better knowledge and technology
 - Climate change
 - Increased risk awareness
 - Human disturbances (both positive and negative)



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Relative weights:

Analytic Hierarchy Process (AHP)

Risk Identification (RI)						
Which one is more important?			In which degree? (1 to 9) 1 = equally important 9 = 9 times more important			
RI1	vs	RI2				
RI1		RI3				
⋮		⋮				
RI5		RI6				

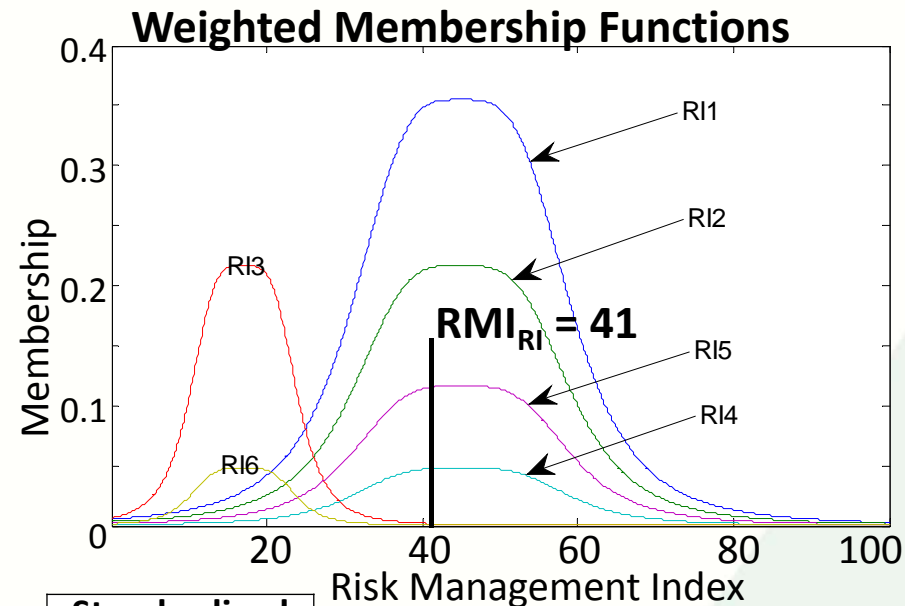
Comparison matrix:

	RI1	RI2	RI3	RI4	RI5	RI6
RI1	1	2	2	5	4	5
RI2	1/2	1	1	5	2	5
RI3	1/2	1	1	5	2	5
RI4	1/5	1/5	1/5	1	1/3	1
RI5	1/4	1/2	1/2	3	1	3
RI6	1/5	1/5	1/5	1	1/3	1

Principal eigenvector



Standardised relative weights
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